Integrated Lights-Out in the ProLiant BL p-Class system

technology brief, 2nd Edition

Executive summary

Computing demands fueled by the Internet and always-on, global enterprises continue to rise, creating the need for businesses to deploy greater numbers of servers. However, the trend to scale out the datacenter leaves system administrators with the challenge of managing the growing electrical, thermal, cable layout, and space challenges of such large computing facilities, in addition to the complexity of system administration for those systems. The ProLiant BL p-Class server blade system is designed to dramatically increase data center space utilization, decrease deployment time, reduce cabling complexities, and provide flawless remote system administration.

The ProLiant BL p-Class server blades each have their own intelligent and autonomous management processor, capable of full network communication and designed to provide unprecedented manageability of both blades and environment. The Integrated Lights-Out management processor provides seamless hardware-based virtual presence, intelligent monitoring and diagnostics, and intelligent interaction with the server blade infrastructure. Because the ProLiant BL p-Class system consists of multiple components — server blades, server blade enclosure, network interconnects, and power subsystem — Integrated Lights-Out incorporates functionality in its firmware to support the modular blade infrastructure, making it easier to deploy and manage.

Readers of this document should be familiar with Integrated Lights-Out technology. For more information about Integrated Lights-Out, see the technology brief titled Integrated Lights-Out Technology: Enhancing the Manageability of ProLiant Servers, document number TC040106TB. It is also assumed that the reader is familiar with server blade architecture in general and the ProLiant BL p-Class system in particular. For more information about the ProLiant BL p-Class system, visit www.hp.com/go/blades

Introduction

The ProLiant BL p-Class server blade system is comprised of modular blade servers optimized for rapid deployment, increased server density, and remote manageability and designed for a wide variety of enterprise and technical computing workloads. To fulfill the requirements of rapid deployment and remote management, the ProLiant BL p-Class system incorporate Integrated Lights-Out in a distributed management processor architecture. Integrated Lights-Out (iLO) is an autonomous management subsystem that resides on each server blade to manage it through any server state, providing virtual presence and control.

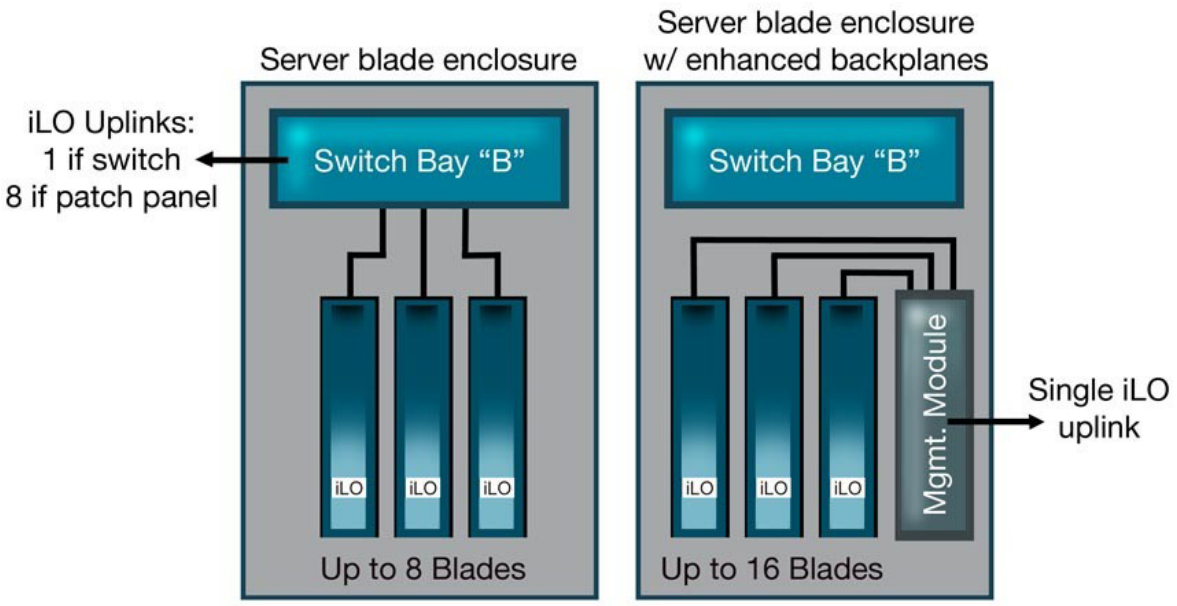
Distributed management processor architecture

For more diverse and complex server environments, an architecture using distributed management processors provides extensive access and control. For example, in the ProLiant BL p-Class system, each server blade contains the Integrated Lights-Out management processor that is tightly coupled with the server blade and blade infrastructure hardware.

Through the use of Integrated Lights-Out Advanced, the ProLiant BL p-Class system provides the highest level of virtual presence available in any ProLiant server — and delivers it in a highly compact blade environment. Integrated Lights-Out intelligently manages the server blade and communicates directly on the network using a dedicated management network port, regardless of the state or condition of the server blade. Furthermore, the localized intelligence of Integrated Lights-Out enables intelligent interaction of the server blade with the server blade infrastructure. This intelligent interaction ensures a robust system implementation across multiple blades and multiple enclosures within a rack.

Figure 1 shows the distributed processor management architecture as implemented in the ProLiant BL p-Class server blade enclosure with enhanced backplanes and in its predecessor, the ProLiant BL p-Class server blade enclosure.

Figure 1. Distributed processor management architecture found in the two ProLiant BL p-Class server blade enclosures offered by HP



ProLiant BL p-Class system

The ProLiant BL p-Class system consists of four key components:

1. Server blades
2. Server blade enclosure
3. Network interconnects
4. Rack-centralized power subsystem

Integrated Lights-Out provides not only the ability to manage the server blade remotely, but also an intelligent communication channel to coordinate events, alerts, and location data throughout the entire infrastructure.

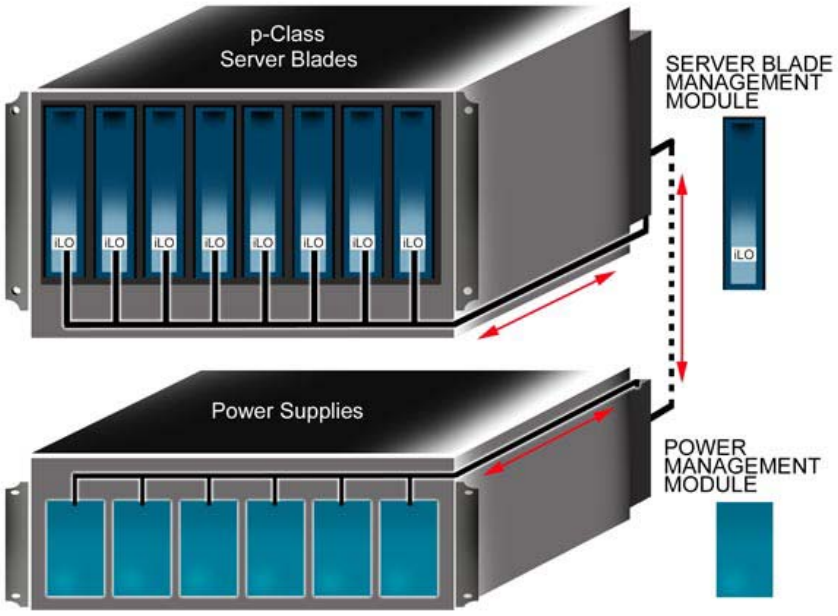
Each server blade enclosure houses up to eight ProLiant BL20p G2, up to sixteen ProLiant BL30p server blades, or up to two ProLiant BL40p server blades, each of which contains iLO Advanced. iLO is composed of hardware and firmware specifically designed to fully monitor the host server blade through any server state: power-on self test (POST), preboot environment, before the operating system (OS) is loaded, while the OS is functional, after an OS failure, or when the server blade is powered down. All features of iLO are enabled by default on the ProLiant BL p-Class server blades, so the administrator has full and immediate access to the powerful Graphical Remote Console and Virtual Media capabilities of iLO Advanced.

Attached to the back of the ProLiant BL p-Class server blade enclosure is a Server Blade Management Module, a self-contained microcontroller that communicates with iLO on each server blade using a management bus accessible by iLO and host software.

The ProLiant BL p-Class server blade enclosure with enhanced backplanes announced in May 2004 has two key differences with its predecessor, the ProLiant BL p-Class server blade enclosure. First, it provides support for the new ProLiant BL30p server blade as well as all other ProLiant BL p-Class server blades. Second, the server blade iLO network connections are accessed via a single iLO port on the Server Blade Management Module rather than on the interconnects. This design greatly simplifies cabling by allowing a single connection for iLOs for an entire enclosure (up to sixteen in the case of the ProLiant BL30p server). All iLOs continue to maintain individual IP addresses.

In the modular ProLiant BL architecture, the rack-centralized power subsystem is decoupled from individual server blades. Power supplies for the ProLiant BL p-Class system are housed in a separate power enclosure. Attached to the rear of the power enclosure is a Power Management Module that monitors the power supplies and power enclosure and is responsible for determining that adequate power is available for newly installed server blades during the power-up sequence. The Power Management Module also delivers alerts and status data to each attached Server Blade Management Module on the server blade enclosure(s).

Figure 2. System communication across the ProLiant BL p-Class components



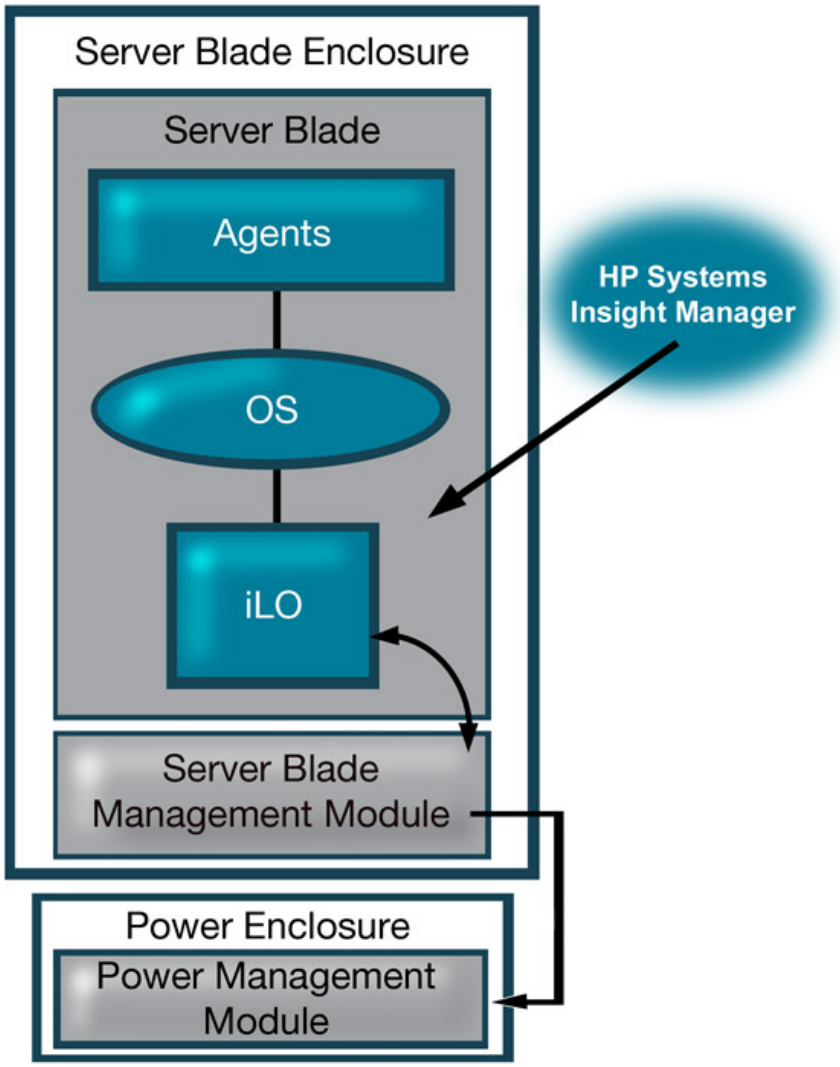
Integrated Lights-Out functionality specific to the ProLiant p-Class system

Integrated Lights-Out incorporates functionality in its firmware to support the blade infrastructure, making it easier to deploy and manage. For example, Integrated Lights-Out enables complete virtual presence and control through its remote management capabilities. Because each server blade contains iLO Advanced, the server blade can query and control crucial aspects of its environment within the infrastructure, such as the power allocation mechanisms. And because of its localized intelligence, dedicated management network, and direct connection to the management console, iLO provides the intelligent communication channels to send alerts and other management information throughout the server blade infrastructure.

Communication

iLO provides a direct communication channel between the management agents, the host OS, the Server Blade Management Module, and the Power Management Module (Figure 3). Through the intelligent management capabilities of Integrated Lights-Out, an administrator can more easily configure and manage the entire infrastructure of the ProLiant BL p-Class system.

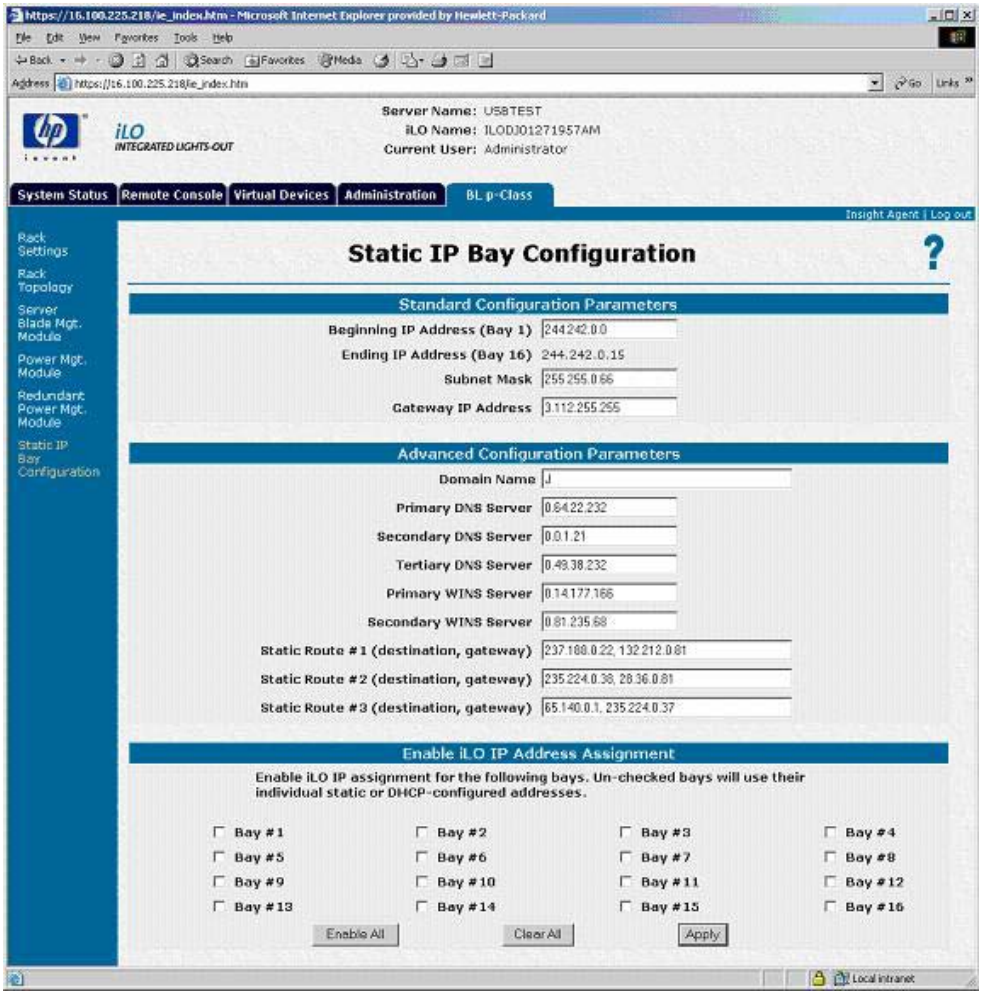
Figure 3. Integrated Lights-Out provides an intelligent communication layer between the OS software and server blade hardware



Static IP Bay Configuration

Static IP bay configuration is a new iLO feature for server blades available in iLO firmware version 1.55 (and above) and using the ProLiant BL p-Class server blade enclosure with enhanced backplanes. While the preferred method for assigning IP addresses to each blade's iLO is through DHCP and DDNS, these protocols are not always available. Static IP bay configuration addresses this situation and significantly eases the deployment of an entire enclosure of server blades by providing a way to automatically assign static IP addresses to a group of server blades without having to configure each server blade manually. Static IP Bay Settings are accessed on the BL p-Class tab in iLO.

Figure 4. Static IP Bay Configuration screen



Static IP bay configuration automates the first step of BL p-Class blade deployment by enabling the iLO management processor in each blade slot to obtain a user-defined IP address without relying on DHCP or manual addressing for each server blade iLO. Once configured using Static IP Bay Configuration, iLO is immediately accessible for server blade deployment using Virtual Media and other remote administration functions.

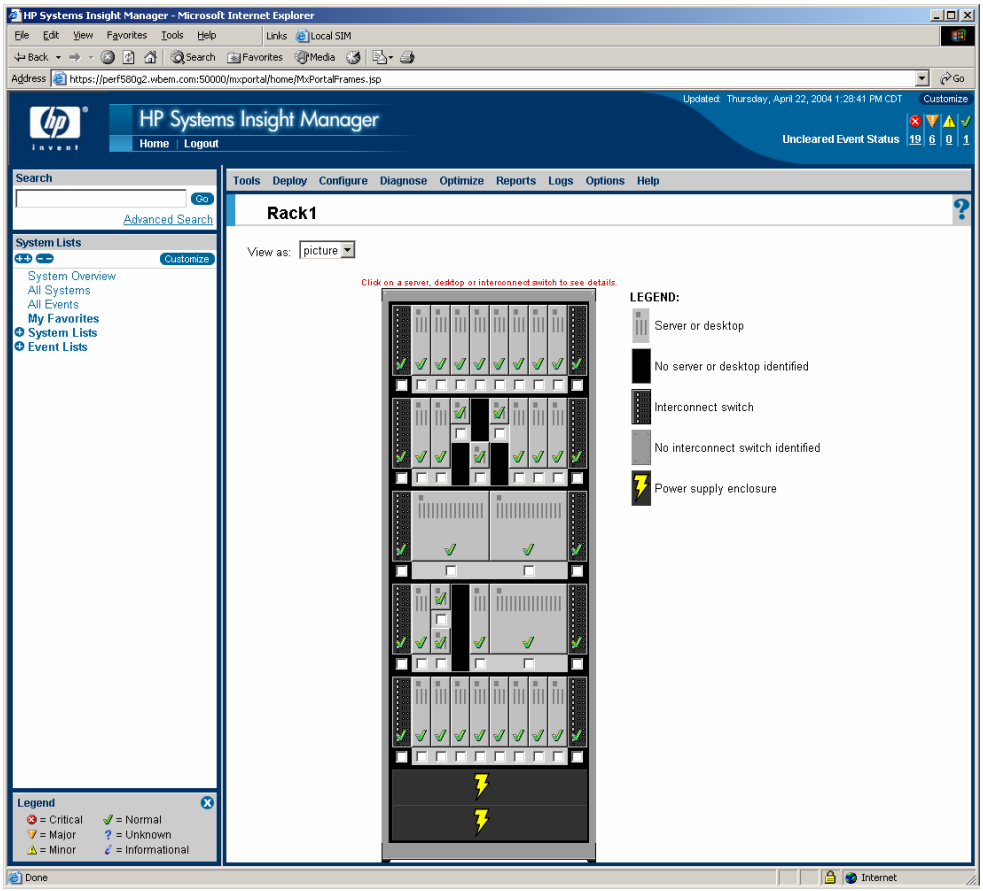
Static IP Bay Configuration enables IP address assignment to each server blade iLO based on a user-provided set of IP addresses and the bay location of the blade in the server blade enclosure.

Remote management

ProLiant BL p-Class server blades are optimized for remote and headless operation, making local keyboard, video monitor, and mouse connections — along with a KVM infrastructure — unnecessary. ProLiant BL p-Class server blades ship from the factory with the iLO Advanced feature set enabled, giving administrators full use of the robust Graphical Remote Console and Virtual Media (floppy and CD-ROM) capabilities. Through these features, customers have the ability to view the server console at all times, to apply software and firmware updates over the network, to access troubleshooting information, to reset the server, and to watch the entire boot sequence from the convenience of a management console. Furthermore, customers are assured that through Integrated Lights-Out, these functions are secure, robust, and always available, regardless of server state or operating system. Thus, ProLiant BL p-Class server blades provide the cost and security advantages of a headless server blade, and in addition, iLO Advanced provides customers with a "remote head" — an always-available keyboard, mouse, and monitor.

Integrated Lights-Out also provides a consistent management interface — the same "look and feel" — across all ProLiant servers platforms, including the BL line of server blades. It is fully integrated with HP Systems Insight Manager to provide in-depth fault, configuration, and performance monitoring from a single management console. Every Integrated Lights-Out device on the network is discovered in Systems Insight Manager as a management processor. The management processor is automatically associated with its host server, without any specific action required by the administrator. Furthermore, Systems Insight Manager includes capabilities for managing server blades and blade infrastructure, inventory and asset tracking capabilities, and the ability to control device discovery through discovery filters. For example, Systems Insight Manager simplifies server blade management by providing graphical representations of ProLiant BL p-Class server blades and their locations within server blade enclosures and racks (Figure 5).

Figure 5. Systems Insight Manager provides a graphical layout of the server blade enclosure



Diagnostic Port and Local I/O Port

For convenient walk-up access or in the event that some portion of the network is down and the administrator cannot reach iLO through the network, ProLiant BL p-Class server blades equipped with either the Diagnostic Port or Local I/O port (depending on server blade model) that guarantee local access to Integrated Lights-Out.

The ProLiant BL p-Class system comes with either a Diagnostic Cable (see Figure 6a) or an I/O Cable (depending on server blade model) that connects to the front of the server blade and provides an RJ-45 network connector. The RJ-45 connector allows an administrator to connect a client device with a browser directly to the blade to access the iLO interface. This design gives the administrator a walk-up virtual KVM, console and virtual media connections to the server blade through the iLO browser interface.

In addition to the RJ-45 connector for iLO interface access, the Local I/O Cable also has two USB ports, one video port and a kernel debug port (see Figure 6b). The Local I/O cable attaches to the front of the server blade (for 2.8-GHz and newer models of the BL20p G2 and for all models of the BL30p).

Figure 6a. Diagnostic Cable connected to the BL20p

Figure 6b. Local I/O Cable connected to the BL20p G2

While the diagnostic port or I/O port on the server blade is in use, the server blade firmware disables the connection to the iLO Ethernet port. The iLO firmware will not switch to the diagnostic port or I/O port (depending on server blade model) if a firmware upgrade, Remote Console session, or XML scripting is in progress through the iLO Ethernet port. This ensures that critical functions are not interrupted. While any of these functions are occurring, the server's blue Unit Identification LED flashes to indicate that the diagnostic port or I/O port (depending on server blade model) is unavailable.

POST LED indicator

iLO firmware has been enhanced specifically for the ProLiant BL p-Class system to provide feedback during the POST process. Because the ProLiant BL p-Class server blades are managed remotely and no monitor is directly attached, an onsite technician or administrator who inserts a new blade into a bay lacks the capability to watch memory count and the POST process; however, the iLO firmware provides an indicator of correct POST operations. Integrated Lights-Out blinks the Server Health LED (green) during the boot process. If the process is completed successfully, the LED will remain green, and control will be returned to the server blade. If the POST process fails, the LED color will change from green to amber.

Power allocation and release

One of the primary responsibilities of iLO in the server blade architecture is to assist in managing the power resources. For a server blade to power on, the necessary power must be available from the infrastructure. iLO verifies with the Power Management Module that there is sufficient power before powering on the server. Any of the following operations sends a power-on request to iLO:

- Physical power button on the server blade is pushed on.
- Wake-on-LAN signal is received. Wake-on-LAN enables an operating system and applications to be installed using the Preboot eXecution Environment (PXE). This allows server blades to be installed in a rack but powered-on and deployed later. Using PXE, a server blade can load and execute a boot image from a PXE server on the network before starting the operating system on the local hard drive.
- Virtual Power Button request is made through the standard web browser of Integrated Lights-Out. Through Virtual Power, an administrator can control power to a server remotely — for example, to force a power cycle of a "hung" server. Like other aspects of Integrated Lights-Out, the Virtual Power feature is controlled in an OS independent fashion and will function regardless of the state of the OS.

- A server blade is inserted into a bay that has the auto-on feature enabled. The Integrated Lights-Out console provides the ability to configure rack settings, such as defining certain bays that will automatically power on if a server blade is inserted.

Once Integrated Lights-Out receives a power-on request, it requests permission from the Server Blade Management Module to power on the blade. The Server Blade Management Module, in turn, inquires from the Power Management Module whether adequate power is available. If sufficient power is available without exceeding the maximum power load, the power system signals that the blade may power up. If there is not enough power available, the power subsystem will reply with a "wait and retry" message. To bring the server blade up as quickly as possible, Integrated Lights-Out will retry the power-on request starting with requests at 15-second intervals. After the first minute, Integrated Lights-Out retries the power-on request in five minute intervals to reduce traffic on the communication bus.

Because there may be cases in which an administrator needs to power on a blade even when the Power Management Module indicates there is insufficient power, Integrated Lights-Out allows a power override. This can be done by two methods, either by holding the physical power button on for five seconds, or by selecting the manual override button from the Integrated Lights-Out Virtual Power web page. The manual override must be used very carefully to avoid possible loss of service and data.

Rack configuration and diagnostics

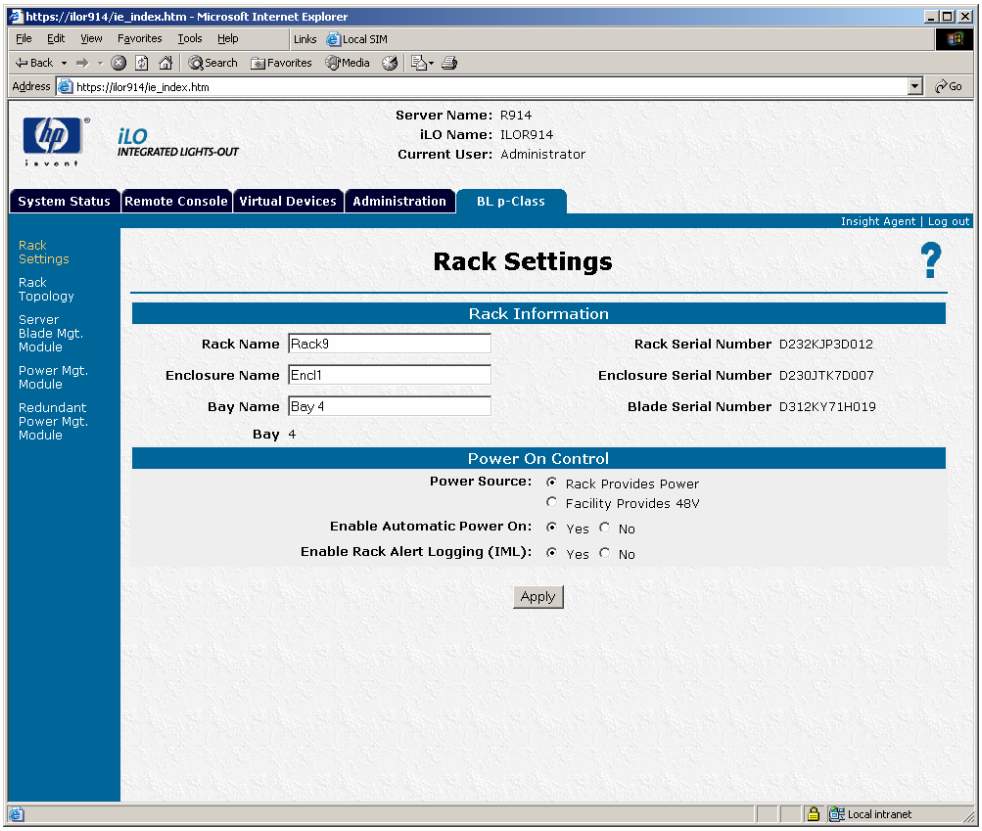
The Integrated Lights-Out web interface provides an additional tab that appears only on ProLiant BL p-Class Systems. This web page provides specific information and configuration abilities applicable to the ProLiant BL p-Class system.

Integrated Lights-Out communicates configuration information to the Server Blade Management Module. The ProLiant BL p-Class server blades have the ability to report their unique physical location to the user through Systems Insight Manager and the Integrated Lights-Out web interface. The ProLiant BL p-Class system provides the following location data to Integrated Lights-Out:

- Rack name – the human readable name assigned to a rack by the user. If the user has not assigned a name to a given rack, a default name of "Unnamed Rack" will be used.
- Enclosure name – the human readable name given to an enclosure within a rack. If the user has not assigned a name to the enclosure, the enclosure's serial number will be used as default.
- Server blade bay number – the number of the bay in a server enclosure into which a ProLiant BL p-Class server blade is installed.

The Integrated Lights-Out stores this blade location information in memory and displays it on its blade-specific web page (Figure 7). When a server blade is inserted into the rack, Integrated Lights-Out queries the rack configuration to update its location. If a rack or blade enclosure name changes, Integrated Lights-Out receives an alert from the Server Blade Management Module and propagates the name change to the other server blades in that affected enclosure.

Figure 7: Example of the Integrated Lights-Out web interface specific to the ProLiant BL p-Class system



Infrastructure diagnostics

The Integrated Lights-Out web interface provides user-level diagnostics of the rack infrastructure. This includes information on temperatures, fans, the Unit Identification LED, the presence of power supplies, firmware revisions of the blade and Server Blade Management Modules and blade and enclosure serial numbers. The infrastructure diagnostics may also be used to view all rack components and to confirm the communication between the rack components. An administrator can use the Rack Topology page to verify that all components are communicating on the rack management bus. The Server Blade Management Module and Power Management Module pages provide more detailed information on these management modules.

Integrated Lights-Out also assists in the upgrading of the firmware in the Server Blade Management Module and the Power Management Module. The OS-based firmware update application communicates the updated firmware through Integrated Lights-Out, which provides an intelligent communication channel between the host OS and the rack infrastructure.

Infrastructure event logs

The ProLiant BL p-Class system includes all the same event and alert mechanisms that are familiar to users of other ProLiant servers. In the modular blade infrastructure, however, these alerts need to be forwarded from shared resources (such as the power supplies) to any server blades that may be affected. Integrated Lights-Out provides the communication mechanism to propagate alerts throughout the infrastructure. For example, if a power supply were removed from a power supply enclosure, the Power Management Module would send an alert to the Server Blade Management Module. The

Server Blade Management Module would then propagate these alerts to all of the Integrated Lights-Out devices on the server blades.

Integrated Lights-Out can also forward SNMP alerts from the infrastructure to the Management Agents. These alerts are then forwarded to Systems Insight Manager or other SNMP-based management consoles. The SNMP alerts include server events such as a host server reset and iLO events such as an unauthorized login attempt.

Location data for rapid deployment

The ProLiant BL p-Class system is designed for an adaptive infrastructure that may require frequent changes to server blade assignments as business needs change. To facilitate such an adaptive infrastructure, the ProLiant BL p-Class system integrates with the ProLiant Essentials Rapid Deployment Pack (RDP) to automate the process of deploying and provisioning server software.

RDP enables "rip-and-replace" functionality specially optimized for the modular ProLiant BL line of server blades. An administrator can assign a defined configuration to one or a group of server blade bays in an enclosure. When a server blade is replaced within an enclosure, the deployment server can immediately install a pre-defined configuration onto the newly installed server blade without local intervention. Integrated Lights-Out obtains the rack name, chassis name, and bay number, and communicates the information to RDP so the correct operating system configurations are deployed.

Use of RDP maximizes customers' IT resources by providing a full server build from a remote, centralized deployment console for initial power on, automated server configuration on the fly, and installation of standard software sets based on customer-defined server configurations. More information about Rapid Deployment Pack is available at www.hp.com/servers/rdp.

Conclusion

Because the computing world is moving towards a management model that relies on virtual presence — in which compute resources can be managed securely, at any time, from anywhere — one of the design criteria for the ProLiant BL p-Class system was the ability to comprehensively manage the blade from a remote location. Therefore, each ProLiant BL p-Class server blade contains the iLO Advanced feature set to provide critical management functionality. Integrated Lights-Out provides specific functionality to ensure adequate power resources for the server blades, tailored web pages specific to the modular blade architecture, and an intelligent communication channel to provide location data for diagnostics, event reporting, and deployment data.

Glossary

SNMP Simple Network Management Protocol

For more information

www.hp.com/go/blades
ProLiant BL p-Class website

Call to action

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